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CURRENT DIVERSITY OF AQUATIC MACROPHYTES IN NIGERIAN FRESHWATER ECOSYSTEM

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ABSTRACT

Uka, U.N.; Mohammed, H.A. & Ovie, S.I. 2009. Current diversity of aquatic macrophytes in Nigerian freshwater ecsustem. Braz. J. Aquat. Sci. Technol. 13(2):9-15. ISSN 1808-7035. In Nigerian inland waters, eight aquatic plants have been incriminated as weeds. From the current study, the most prevalent of these weeds are water hyacinth and cattail plants. These aquatic weeds, once it invades a water body, not only disrupts the ecology of the systems but adversely affects the sociological, cultural and economic realities of the local communities within the area, especially the artisanal fisher folks. This paper showcases aquatic weeds distribution country wide based on its hydrological areas as well as their controlling methods. These methods, when employed in aquatic weed infested water bodies, will manifestly contribute to the success of approaches geared to solving aquatic weed problems.

Keywords: Aquatic macrophytes, Inland waters, Distribution, abundance and Management.

INTRODUCTION

It is a known fact that about 70% of the earth surface is covered with water. About 98% is unconducive for agriculture and drinking. Only extremely small amount are readily available as rivers, streams and lakes. Unfortunately, the available freshwater is not evenly distributed throughout the world. It now rests on man to properly manage this ecosystem. The importance of freshwater bodies as an environmental resource that can be used for the benefit of mankind cannot be overemphasized. These water bodies are important for fisheries, domestic and industrial water supplies among others. Therefore the management of water from its source to utilization is necessary in order to maintain the life functions.

The infestation of freshwater bodies by aquatic weeds influences water management in waterways, rivers, reservoirs and canals. Aquatic weeds are aquatic plants which interfere with the use of water, or in some way constitute a nuisance to man or hazard to human welfare, or growing on a water body where it is not desired (Mitchell,1985). There is an ecosystem imbalance between aquatic plants and other aquatic organisms when the plants invade the system and grows excessively to a nuisance level. The excessive growth of aquatic weed restricts fishing, swimming and recreational activities, causes foul taste and odour of drinking water supplies. It also leads to stunting of fish populations and fish kill due to decomposition (AERF, 2005).

Some alien aquatic plants, for example water hyacinth, have invaded Nigerian freshwater ecosystem causing considerable socio-economic problems. These invasive aquatic weeds affect biodiversity as well as water quality (Uka, 2006). Vegetative reproduction of aquatic plants is well developed that once introduced, they can propagate vigorously in suitable habitat. The uniformity and mildness of aquatic environments as compared to terrestrial ones are also factors that enable the spread of many alien aquatic plants over a wide range. This paper therefore attempts to review the status of aquatic weed infestation in Nigeria and as well discuss components of aquatic plant management plan.

AQUATIC WEED DISTRIBUTION IN NIGERIA

The distribution of aquatic weeds in Nigeria has basically been influenced by human factors such as environmental manipulation, pollution, expanded use and development of water bodies for irrigation, transportation, recreation and other public purposes (NIFFR, 2002). Other factors include flooding, environmental factor and photosynthetic efficiency. The comprehensive checklist of the aquatic plants in Nigeria is presented in Table 1. The dominant aquatic weeds of the aquatic environment of Nigeria are shown in Table 2. The spatial distribution

Table 1 - Checklist of Nigerian aquatic plants.

Family/Species	Number of species	Family/Species	Number of species
ALISMATACEAE	7	**MARANTACEAE**	1
Burnatia enneandra		*Thalia geniculata*	
Cladesia oligococca		**MENYANTHACEAE**	1
C.reniformis		*Nymphoides indica*	
Limnnophyton obtusifolium		**MIMOSACEAE**	2
L.fluitans		*Mimosa pigra*	
Sagittaria (Lophotocarpus) guayanensis		*Neptunia oleracea*	
Wiesneria schweinfurthii		**NAJADACEAE**	1
ARACEAE	1	*Najas horrida*	
Pistia stratiotes		**NYMPHAECEAE**	4
AMARYLIDACEAE	1	*Nymphaea lotus*	
Crinum natans		*N.maculate*	
APONOGETOMACEAE	2	*N.micrantha*	
Aponogeton subconjugatus		*N.guineensis*	
A.vallisnerioides		**ONAGRACEAE**	6
AZOLLACEAE	1	*Jussiaea repens Var.diffussa*	
Azolla Africana		*(Ludwigia stolonifera)*	
CERATOPHYLLACEAE	1	*Ludwigia decurrens*	
Ceratophyllum demersum		*L.erecta*	
CONVOLVULACEAE	2	*L.leptocarpa*	
Ipomoea aquatica		*L.suffruticosa*	
I.asarifolia		**PARKERIACEAE**	1
CYPERACEAE	5	*Ceratopteris cornuta*	
Cyperus alopecuroides		**PODOSTEMONACEAE**	2
C.articulatus		*Tristicha hypnoides*	
C.exaltatus		*T.trifaria*	
C. submicrolepis		**POLYGONACEAE**	3
Scirpus cubensis		*Polygonum lanigerum*	
GRAMINAE (POACEAE)	12	*P.salicifolium*	
Echinochloa Colonum		*P.senegalense*	
E.Pyramidalis		**PONTEDERIACEAE**	4
E.Stagnina		*Eichhornia crassipes*	
Leersia hexandra		*E.natans*	
Leptochloa caerulescens		*E.diversifolia*	
Oryza longistaminata		*Heteranthera callifolia*	
O.perennis		**POTAMOGETONACEAE**	2
Phragmites karka		*Potamogeton octandrus*	
Phytachne triaristata		*P.schweinfurthii*	
Sacciolepis arundinaceum		**RUBIACEAE**	1
Sorghum arundinaceum		*Mitragyna inermis*	
Vossia cuspidate		**SALVINIACEAE**	1
HYDROCHARITACEAE	2	*Salvinia nymphellula*	
Ottellia ulvifolia		**SCROPHULARIACEAE**	1
Vallisnera spiralis		*Limnophila barteri*	
LEMNACEAE	3	**SPENOCLEACEAE**	1
Lemna aequinoctialis		*Sphenoclea zeylanica*	
L. perpusilla		**TRAPACEAE**	1
Spirodela polyrrhiza		*Trapa bispinusa*	
LENTIBULARIACEAE	8	**TYPHACEAE**	1
Utricularia reflexa (charoidea)		*Typha australis*	
U.gibba subsp.Exoleta			
U.inflexa var inflexa			
U.reflexa (platyptera)			
U.rigida			
U.vitellaris			
U.inflexa var.inflexa (thonningii)			
U.benjaminiana (villosula)			
	Total species		**76**

Source: Ita (1994)

Table 2 - Aquatic vegetation incriminated as weeds in Nigeria.

Scientific names	Common names
Alternanitaera sessile	
Azolla Africana	
Ceratophyllum demersum	Ceratophyllum
Commelina benghalensis	
Cyperus spp	Reed
Eichhornia crassipes	Water hyacinth
Ipomoea aquatica	
Leersia hexandra	Wild rice
Ludwigia stolonifera	
Mimosa pigra	
Nymphea lotus	Water lily
Nypa fructicans	Nypa palm
Pistia stratiotes	Water lettuce
Polygonum lanigerum	
Salvinia nymphellula	Water fern
Scrippus spp	
Typha latifolia	Cattail

Source: NIFFR (2002)

of aquatic weeds in major inland water bodies found in the hydrological areas is as shown in table 3.

National Institute for Freshwater Fisheries Research estimated the abundance of water hyacinth and other aquatic weeds in Nigeria using Line intercept method (Madsen, 1999). The qualitative rating of aquatic weeds infestation in Nigeria inland waters as shown in table 3 revealed that *Eichhornia crassipes* (Water hyacinth) and *Typha latifolia* (Cattail) are the most noxious aquatic macrophytes in our waters and more so, they are widely distributed. In order to manage these invasive aquatic macrophytes, there is the need to fashion out management strategies. These will prevent introduction of nuisance plants, provide an early detection and rapid response programme on the waterbody so that new introductions can be managed quickly at minimal cost, and aid in identifying problems at an early stage. Planning will show case known information as well as knowledge gap.

STRATEGIES FOR WATER HYACINTH MANAGEMENT AND CONTROL

One of the ways of adopting an effective control and planning is premised on the establishment of the abundance and distribution of the weed infestation. Surveillance trips are usually undertaken first to establish the extent and types of infestation and to decide on the method of control to be used.

In 1994, the Nigerian government initiated water control measure in Kainji Lake Basin, enlightenment campaign was carried out to determine knowledge level of the fisher-folks concerning the water hyacinth infestation on the lake and the associated problems, deciding on plan of action towards controlling and eliminating the weed on lake Kainji and enlightening fisherfolks on additional scientific information on the characteristics of the weed (Alamu *et al.*, 2000). The enlightenment campaign attracted many stakeholders who were greatly involved in the physical removal of the weed from the beaches. The campaign contributed in no small measure in increasing the knowledge level of the local people. Organized training sessions were conducted for members of the local communities and Technical Staff who were actually involved in the control program.

It is necessary to include the monitoring of other biological communities in reservoir, to evaluate if adopted management options have positive or negative effects on the water body. It is also desirable to include baseline data collection in monitoring Programs. In Kainji lake, monitoring team was set up by the National Institute for Freshwater Fisheries Research and the Nigerian German Kainji Fisheries Promotion Project were responsible for monitoring the extent of the clearing activities in the communities and liaising with fishing communities on progress made concerning other methods by the Nigerian government. A remarkable achievement was made with co-operation of the fishing communities.

METHODS OF AQUATIC WEED CONTROL

The aquatic weed control is carried out using these methods; Physical or mechanical control; Biological control and Chemical control. These methods have been summarized in Table 4 below.

RECOMMENDATIONS

According to Madsen 2005 Components of a plan includes: Prevention, Problem Assessment, Project Management, Education, Monitoring, Site- or problem-specific management goals, and Evaluation. Prevention seeks to reduce the influx of new invaders into the resources, and respond rapidly once they are found. Problem assessment is to quantify the distribution and abundance of the target plant and its impacts on the resource.

Project Management includes tracking available resources to fight the problem, including funds and labor. Education involves informing both the resource agency and the public in the problem and potential solutions.

A monitoring component tracks the general condition of the resource in both biotic and abiotic attributes, to detect other changes associated with the resource. a Site- or problem-specific goal addresses the

Table 3 - Distribution of aquatic weeds in major inland water bodies found in the hydrological areas.

RIVER BASINS /STATE	Aquatic weeds	Affected/Infested areas
Upper/Lower Niger River Basin Niger,Abuja,Kaduna, Plateau,Nassarawa, Benue,Kogi& Kwara	*Echhornia crassipes,* *Nymphea lotus* *Pistia stratiotes, Cattail* *Ceratophyllum demersum* *Salvinia nymphella,* *Vossia cuspidate* *Typha latifolia* *Phragmite karka* *Echinochloa spp*	Kaduna river, River Niger, Lake Kainji lake, Shiroro lake, Tagwai dam,Kangim dam,River Benue,,River Katsina-Ala,Swamps, Reservoirs,Oshin,Afelele, Awon,River/Benue confluence
Upper/Lower Benue River and Chad Basin Adamawa Bauchi Gombe Borno Taraba Yobe	*Typha latifolia* *Eichhornia crassipes* *Nymphea lotus* *Pistia stratiotes*	Kiri dam, Lake Geriyo,River Benue,River Gongola,Lake Chad,Alau reservoir.Dadinkowa dam, Canal of lake Balanga,Gubi dam
Hadejia/Jama'are Sokoto-Rima River Basin Kebbi Sokoto Zamfara Katsina Kano Jigawa	*Azolla sp,* *Polygonium lanigerium,* *Mimosa pigra,* *Alternanitaera sessilis,* *Echinochloa spp,* *Ludwigia spp,* *Ceratophyllum demersum,* *Scrippus spp,* *Pistia stratiotes* *Polygonium spp* *Commelina benghalensis* *Typha latifolia* *Nymphea lotus*	River Argungu,Kwari Lake, Lake Natu, Jankara reservoir Ruwan Kanya Reservoir Kunde Reservoir, Hadejia Jamare'are wetlands
Osun,Ogun and Owena River Basin	*Eichhornia crassipes* *Nymphea lotus* *Pistia stratiotes* *Ceratophyllum demersum* *Leersia hexandra* *Ludwigia stolonifera* *Ipomea aquatica* *Cyperus exaltatus* *Water fern* *Water lettuce*	Warri river,Ethiope river, Ase river, Niger river,Gelegele river Siloko river ,Ofunama river, Ikoro river,Ikpoba reservoir,Ogbese/Owa river, Ovia/Igueben dam Oghodegbeda dam River Tolita, Oluwa,Siluko,Alape,Ofara and Apata rivers Okubakuku, Adelesimo, Obenta, Legha Aiyetoro Western Mahin and Biobu creeks. Ede, Esa, Odo, Oke Ede, Iwo reservoirs. Okinni Owala, Osun, Oba, Otin, Asejire and Oora swamp. Eleyele reservoir, Ere creek, Yewa river, Akere reservoir,Ogun,Oyan,Iro/Moloki and Okomayo rivers,Lekki lagoon,Badagry creek, Lagos lagoon, Lagos Harbour,Omu creek, Epe,Five Cowrie,Epe lagoon and Abessan river.
Anambra,Imo,Niger Delta and Cross River Basin	*Eichhornia crassipes, Water lettuce, Water fern, Water lily, Typha latifolia, Ipomea aquatica*	River Niger,Obanliku reservoir,Obudu reservoir and Blue river

Source: NIFFR (2002)

Table 4 - Qualitative rating of level of aquatic weeds infestation in Nigeria inland waters.

STATE	TYPES OF WEEDS				
	EC	PS	NL	TA	OW
Abia	+ + +	+ + +	+ + +	+	
Adamawa	+ + +	+ + +	+ +	+ + +	
Akwa-Ibom	+	+	+ +	+	
Anambra	+ + +	+ +	+ +	+	+
Bauchi	-	+ +	+ +	+ + +	
Bayelsa	+ +	+ +	+ +	+	
Benue	+ + +	+ +	+	+ +	
Borno	-	+ + +	-	+ + + +	
C/River	+ +	+ + +	+ +	+	
Delta	+ + + +	+ +	+ +	+ +	+ +
Ebonyi	-	+ + +	+ +	-	
Edo	+ + + +	+ +	+ +	+ +	+ +
Ekiti	+ + +	+ +	+ +	+	+
Enugu	-	+ +	+	+	
FCT,Abuja	+ +	+ + +	+ +	+ +	
Gombe	+ +	+ + +	+ + +	+ + +	
Imo	+ + +	+ +	+ +	+	
Jigawa	-	+ +	+ +	+ + + +	
Kaduna	+ +	+ +	+ +	+ +	
Kano	+ + +	+ +	+ +	+ + + +	
Kebbi	+ + + +	+	+	+ +	+ +
Kogi	+ + +	+ +	+ +	+ +	
Kwara	+ + + +	+ + +	+ +	+ +	
Lagos	+ + + +	+ +	+ +	+ +	
Nassarawa	-	+ +	+ +	+ + +	
Niger	+ + + +	+ + +	+ +	+ +	
Ogun	+ + + +	+ +	+ +	+ +	+ +
Ondo	+ + +	+	+ +	+	+
Osun	+ +	-	+ +	+	+ + +
Oyo	+ +	+ +	+ +	+ + +	+
Plateau	+	+	+	+	+ +
Rivers	+ +				
Sokoto	+ +	+ +	+ +	+ + +	+ +
Taraba	+ + +	+ + +	+ + +	+ + +	
Yobe	-	+ +	+	+ + +	
Zamfara	-	+ +	+ +	+ + +	

Key: **-** = Absent; + = Rare; + + = Slight; + + + = Moderate; + + + + = Extensive
EC = *Eichhornia crassipes* **PS =** *Pistia stratiotes* **TA** = *Typha latifolia* **OW**= Other weeds
Source: NIFFR (2002)

management of target species based on a specific site basis, rather than attempting to find a single solution to the target plant problem through time for all locations.

Aquatic weeds infestation in Nigeria waters is increasing geometrically. This can be attested to considering its infestation in almost all the streams, lakes, rivers and reservoirs. Government intervention is basically during critical situations. Therefore adequate budgetary provisions should be made and institutions involved in management and control of aquatic weeds strengthened.

Our freshwater is a public amenity and as such should be in harmony with the environment. None of the control methods will guarantee the success of aquatic weed management. An integrated approach, including utilization of weeds as a resource is a way of protecting the quality of the environment. Therefore to develop more effective ways of managing aquatic weeds, better knowledge of biological, ecological and economical aspects of aquatic macrophytes are needed.

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Table 5 - Summary of management options for the control of aquatic weeds.

Management trategy	Description	Advantages	Disadvantages	Plant species Response
Hand pulling	Direct hand pulling or use of hand tools	Completely removes nuisance plants	Can be labor intensive depending on size to be treated	Very effective in localised areas.
Draw down	Lowering water level may be manipulated in the fall to allow sediments and plants to freeze, and dry out.	Inexpensive, very effective, moderate-term	Can have severe environmental impacts. will effect all plant species and wild life, may effect access to water supplies increase post-drawdown nutrient levels and turbidity.	Selective based on timing. Effective on evergreen perennials, Less effective on herbaceous perennials
Benthic Barriers	Natural or synthetic materials to cover plant	(Black screened secured to lake bottom like a carpet) Blocks sunlight and prevents growth, impedes fragmentation.	High maintenance, Effects non-target plant and soil below barrier.	Nonselective, plant mortality within one month underneath barrier.
Floating nets	Total removal of plants and associated sediments.	Enclose small area cover or inlet) to inhibit spread of plant fragments	Requires proper anchor, can impede boating, swimming and fish movement	
Dredging	Total removal of plants and associated sediments	Creates deeper water, very long-term results	Very expensive, alters lake ecology, will impact all plants and wildlife, may cause water quality problems	Often creates large areas of lake tempora free of plants, not selective.
Chemical control	Control of herbicides by use of herbicides	-Can control large areas, -Chemical may be specific to plant species, -Results may be seen rapidly and one application may work for 1-3 years, but more may be required.	High initial cost; requires state permit; use of water body for swimming and drinking often limited for period of time after application.	Selective -Systemic growth regulator -Non selective
Biological Controls	Exploitation of living organism or their products to reduce or prevent the growth and reproduction of weeds	Introduction of natural prey (insects, fish) into lake to control plant population; often highly specific for plant target	-Introduction of new species may be problematic (or unethical); -Highly experimental and may require permit.	Reduction in plant mass , -Reproduction and density due to leaf, stem, flower and root feeding.

Source: **Lancar & Kraker (2002) and Madsen (1997 and 2000)**

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